Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matters of	)	
	)	
Deployment of Wireline Services Offering Advanced Telecommunications Capability	))	CC Docket No. 98-147
	)	
and	)	
	)	
Implementation of the Local Competition Provisions of the Telecommunications Act of 1996	)))	CC Docket No. 96-98

COMMENTS OF CATENA NETWORKS, INC.

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Catena Networks, Inc. ("Catena") hereby comments on portions of the Commission's Further Notice of Proposed Rulemaking concerning collocation, including collocation of Competitive Local Exchange Carriers ("CLECs") in remote terminals deployed by the Incumbent Local Exchange Carriers ("ILECs").[1] The Commission seeks input on how it should modify its collocation requirements in light of the increasing deployment by ILECs of remote terminals, including next-generation digital loop carrier systems. As explained below, Catena believes the Commission can take steps to enhance competition between ILECS and CLECs, as well as competition with other broadband providers such as cable operators, but it must be careful to do so in a manner that does not stifle the development and deployment of new technologies.

[1] *Deployment of Wireline Services Offering Advanced Telecommunications Capability*, FCC 00-297, released August 10, 2000 (hereafter cited as "*Further NPRM*").

As a leading developer of advanced communications systems, Catena is well qualified to address the issues raised in the *Further NPRM*. Catena is a privately-held corporation, headquartered in Redwood Shores, California, with its research and development operation in Kanata, Ontario, Canada. Catena was founded in December 1998 with a vision to create the New Access Architecture for the Converged Public Network and, in the process, make broadband access as ubiquitous as plain old telephone service (POTS).

As the explosive growth in Internet usage continues to inundate today's telephone network, Catena's breakthrough innovations will revolutionize the subscriber interface to the converging voice and data networks. Catena markets its products to service providers, including ILECs and CLECs, seeking the ability to transform their subscriber lines for the efficient delivery of broadband data and voice services. Carriers deploying Catena broadband systems will have the ability to carry out a line-by-line migration from today's circuit-switched network to the packet-based network of tomorrow, while retaining their reliable lifeline services.

Catena’s management and staff bring with them a wealth of experience. The Catena development team consists of some of the industry's top design and system engineers in the access technology field, with extensive experience in developing and deploying high-volume POTS, DSL, cable telephony, cable data and ISDN. Specifically, the team draws on an unparalleled record of delivering high-performance, cost-optimized systems for high-volume deployment—with more than 150 million lines of existing designs currently in service worldwide.

Summary of Catena Networks' Position

Catena supports the Commission's efforts through the *Further NPRM* to promote competition and make advanced services available to all Americans. In a related vein, Catena also applauds the Commission's recent Order granting SBC's request to allow the deployment of highly efficient and cost-effective integrated POTS + DSL plug-in cards in its incumbent local exchange carriers' remote terminals.[2] Catena's focus is to drive technology innovation and integration to enable advanced services, specifically DSL, to be as ubiquitous, affordable and available as POTS is today. Catena believes that the Commission's forward thinking to facilitate the deployment of new integrated technologies, as reflected in the *Pronto Waiver,* will promote competition by lowering the competitive economic barriers, and will significantly speed deployment and availability of advanced services to the millions of Americans served from remote terminals.

According to RHK,[3] one out of every three Americans is currently served from remote terminals. RHK further predicts that within the next three years, more than half of the U.S. telephone subscribers will be served from remote terminals. These market forecasts have been confirmed in our discussions with potential customers. Service providers have indicated that the access network trend is to shorten subscriber loops and deploy fiber closer to the subscriber through the extensive use of remote terminals. As a result, the Commission's decision in this proceeding with respect to the regulatory collocation model for remote terminals will substantially affect the fate of advanced

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[2] *Ameritech Corp. and SBC Communications, Inc., Second Memorandum Opinion and Order,* FCC 00-336, released September 8, 2000 (hereafter cited as "*Pronto Waiver*").

[3] *RHK 2000 Access Network System Market Forecast*, February 29, 2000

services to the growing millions of Americans that are now or will be served from remote terminals.

Catena strongly encourages the Commission to adopt a regulatory collocation model for remote terminals that is consistent with the virtual unbundling model applied in the *Pronto Waiver*. Specifically, the remote terminal collocation model must allow the integration of POTS and DSL on a single subscriber loop interface. Technology innovation and integration is currently yielding solutions that will make advanced services as ubiquitous, affordable and available as POTS is today. The constraint on this "utopian" vision is not technology. Rather, it is a concern that regulatory issues with respect to pricing, ownership, control and product differentiation could stifle the deployment of these advances in technology.

Catena is extremely concerned that the premise of several questions raised in the *Further NPRM* is that the collocation model of the Central Office (including the use of POTS Splitters as the demarcation point for line sharing) should simply be extended to remote terminals.[4] Catena believes that the Central Office collocation regulatory model is <u>not</u> extendable to remote terminals, and any rulings along these lines will result in severe network inefficiencies. Imposing an obligation to conform technology to a separate overlay, non-integrated remote terminal regulatory model will result in significant economic barriers to competition, slow deployment, and limit the availability and affordability of advanced services to a large portion of America. Indeed, assuming the accuracy of market projections showing that 50 percent of Americans will be served via remote terminals, half of the population will effectively be denied access to these

[4] *E.g.*, *Further NPRM* at ¶¶ 104, 105, 109 and 133.

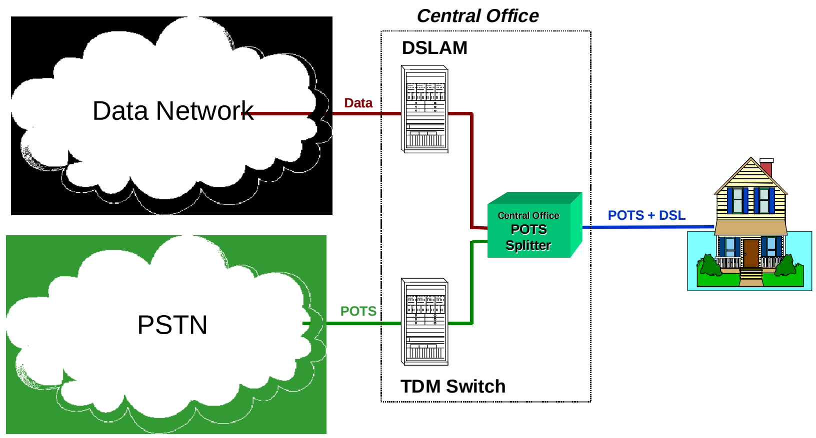
advanced services. Catena believes that the "virtual collocation" paradigm for remote terminals, similar to the architecture addressed in the *Pronto Waiver*, is by far the most technically efficient and cost effective model. This model reduces the economic barriers to competitive access, thus speeding deployment, availability and affordability of advanced services to all Americans. As discussed, this regulatory model supports competition between ILECs and CLECs. In addition, by allowing wireline carriers to take advantage of advances in technology, it also enhances competition with other service providers offering broadband services, such as cable and wireless operators.

Discussion

Catena Networks strongly encourages the Commission to adopt a virtual collocation model for remote terminals, similar to the integrated POTS + DSL plug-in card deployment architecture allowed in the *Pronto Waiver*. As discussed below, there are significant problems with collocation at remote terminals, numerous advantages of integrated POTS + DSL linecard architectures, severe problems with POTS Splitters, and important advances in technology that must all be weighed carefully in the Commission's decision on the future of advanced services provided from remote terminals.

The Problem with Simply Extending the CO Collocation Model to Remote Terminals

The current DSL architecture being deployed in Central Offices consists of the incumbent's POTS switch, mechanical POTS Splitters and the data affiliate's DSLAM, as well as multiple competitive carriers' DSLAMs (see Figure 1).



Current DSL deployment model in Central Office

Figure 1

This deployment model is difficult to extend to remote terminals for the following reasons:

Space Constraints

Central Offices have the luxury of having collocation space available for DSLAMs for the data affiliate and multiple competitive carriers. RTs are located at the edge of neighborhoods in small, outside-plant cabinets, CEVs (Controlled Environmental Vaults), huts or mounted on poles. In the majority of cases, space is not available to place overlay DSL equipment.

Right-of-way issues, aesthetics and high costs deter service providers from building "cabinet farms" at the edge of neighborhoods to house overlay DSLAMs and POTS Splitters. To further complicate matters, the SAI (Subscriber Access Interface) is not always collocated with the RT equipment. As a result, carriers are forced to implement non-standard wiring methods to gain access to subscriber loops.

Capital Costs

Implementing overlay DSL deployment architectures for RTs can result in high start-up costs. Most overlay remote DSL solutions require new cabinets, pouring new concrete pads, incremental commercial power, etc. These significant start-up costs require a significant DSL penetration level for service providers to justify DSL deployment in many remote locations.

Smaller Serving Areas

As fiber is deployed closer to subscribers, serving areas become increasingly smaller. While DSLAMs in Central Offices have access to thousands and tens of thousands of subscribers, many RT sites address fewer than 200 subscribers. Seventy-five percent (75%) of all RTs deployed address 700 lines or less. [5] These small serving areas make it difficult for data affiliates and CLECs to justify the high initial investment required to put overlay DSL infrastructure in place to compete for such a limited number of subscribers.

Speed of Deployment

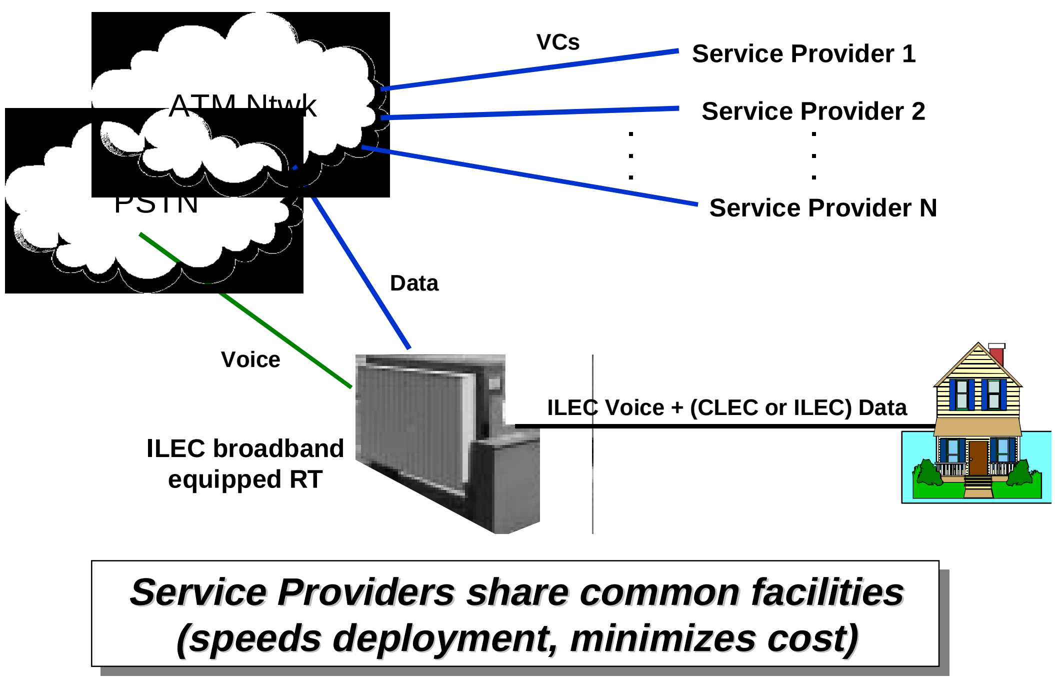
Overlay DSL solutions at remote sites typically result in complex installations -- obtaining building permits/zoning changes, pouring concrete pads and installing remote cabinets for POTS Splitters and remote DSLAM equipment, etc. all take significant time. These installations are also time consuming and resource-intensive, making it difficult for service providers to quickly respond to DSL demand.

[5] RHK 2000 Access Network System Market Forecast, February 29, 2000

The Solution: Integrated POTS + DSL Linecard Based Solutions

To enable the deployment of advanced services, and to address the significant and growing installed base of subscribers served from RTs, service providers must implement a DSL deployment model that is simple, elegant, easy to deploy and cost effective. One such solution is the implementation of integrated POTS + DSL linecards.

Integrated POTS + DSL linecards enable service providers to quickly and easily upgrade the large installed base of RTs for DSL service. In addition, new and emerging RTs can be deployed pre-equipped with integrated POTS + DSL linecards. The architecture depicted in Figure 2 (below) illustrates the simple and elegant solution that integrated POTS + DSL linecards enable.



DSL deployment Model for Remote Terminals

Figure 2

The integrated POTS + DSL linecard fits into the existing RT linecard slot. DSL gains direct access to the POTS loop, thus eliminating any complex and time-consuming wiring to the protection block, SAIs, POTS Splitters, etc. In addition, the integrated POTS + DSL linecard eliminates the need for incremental equipment, incremental cabinets, larger cabinets, pouring new pads and all the issues related to overlay solutions. With advanced technologies such as Catena's, the POTS + DSL linecard takes up no more room and virtually no more power than a linecard offering POTS only.

Under the integrated model, the POTS service remains intact and the voice traffic continues to be backhauled to the Central Office over the existing POTS transport infrastructure. There are no changes or impacts to the existing ILEC voice operations, maintenance or procedures.

The DSL traffic is directed to a new, common ATM network interface card, placed in an available slot with backplane access to each linecard. The DSL traffic is aggregated on the ATM card and interfaces to the carrier's transport system via T1s, DS-3 or OC-3. The DSL traffic is backhauled to an Optical Concentration Device (OCD) at the Central Office. [6] The DSL traffic is unbundled at the OCD and available to the data affiliate and competitive carriers via virtual circuits (VCs). In light of this architecture, contemporary technologies support service differentiation within the shared physical resources.

Advantages of Integrated POTS + DSL Linecards

The deployment architecture using integrated POTS + DSL for RTs significantly speeds DSL coverage for more than 68 million subscribers. This deployment technique is relatively simple, elegant and inexpensive. Integrated POTS + DSL linecards enable the following DSL coverage benefits:

DSL Coverage

RT serving areas account for a significant portion of the target DSL subscriber base, expected to grow to one-half. This simple, elegant and inexpensive implementation enables service providers to launch mass-market service campaigns.

Simple and Elegant

Integrated POTS + DSL linecards eliminate the need for overlay cabinets, complex wiring, pouring new pads and resource-intensive installations.

Low Start-up Cost

RTs can be equipped for DSL service on a linecard-by-linecard basis. This level of granularity, and eliminating the need for incremental or enlarged cabinets, keeps start-up costs at minimum.

Scalable

The continued advancements in DSL silicon technology allow service providers to upgrade existing RTs, as well as new and emerging RTs, on a granular, linecard-by-linecard basis to address required and projected DSL penetration levels — with no reduction of POTS port capacity.

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[6] Under Catena's view of an integrated system, the OCD is an ATM switch.

Speed of Deployment

Simple linecard upgrades can be deployed much more rapidly than overlay solutions.

Amortized Backhaul

All the DSL traffic is backhauled to the OCD for service unbundling using a single facility. Thus, the cost of DSL backhaul facility is amortized over all the DSL subscribers in the serving area. As a result, service providers achieve the most cost-effective and efficient architecture to provide DSL service to this subscriber base.

Reliability

The integrated POTS + DSL linecard deployment model eliminates complex wiring, eliminates the need for overlay equipment and significantly reduces the number of failure points in the network.

Economically Viable

An integrated POTS + DSL linecard deployment architecture for RTs is by far the most cost effective, expedient method for service providers to achieve mass-market DSL deployment in remote serving areas. Viable economics enable service providers to offer affordable DSL services to this significant segment of the subscriber base. The integrated POTS + DSL linecard deployment architecture significantly lowers the barrier to entry for competitive service providers, resulting in a more competitive environment for DSL service offerings.

<u>The Problem with POTS Splitters in RTs</u>

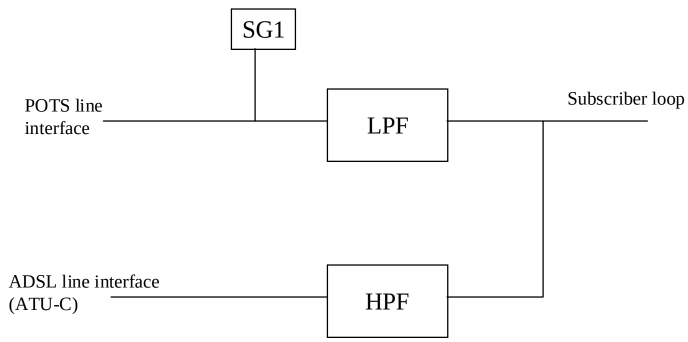
Line Sharing Test Access Implications on POTS Splitters

Another problem with simply extending the current CO model to remote terminals is the continuation of a POTS Splitter as the demarcation point for line sharing.

While the POTS Splitter provides effective separation of the high and low frequency paths, it introduces many undesirable problems. These problems include:

- multiple wires to/from the wiring panel
- large size and high cost because of the utilization of large, bulky capacitors and magnetics

Figure 3 shows the basic elements of the traditional POTS Splitter. LPF is a low pass filter that couples the low frequency POTS spectrum onto the subscriber loop (0 to 4 kHz). HPF is a high pass filter that couples the high frequency DSL spectrum onto the subscriber loop (typically 30 kHz to 1.1 MHz). SG1 is a signature that indicates that a POTS splitter is present on the line when an appropriate DC test is performed by the test head connected to the POTS test bus.



Traditional POTS splitter

Figure 3

The traditional splitter proved to be an effective way to allow the addition of ADSL data service by a CLEC to the traditional voice service provided by the ILEC for initial deployments. However, the splitter introduces several problems when one considers the operational concerns to both the ILEC running a reliable voice network, as well as the CLEC running a reliable data network.

The traditional POTS Splitter introduces several problems that need to be resolved to implement test access for line sharing as required by the Commission. These include:

- The HPF in the traditional POTS splitter implements blocking capacitors that limits test access to high frequencies only, and the HPF eliminates the ability to perform DC and low-frequency tests. These tests are necessary to detect extraneous voltages on the tip and ring leads, as well as capacitive or resistive faults between tip, ring and ground.

- Tests performed by the Competitive LEC at DC and low frequencies could interfere with lifeline POTS services provided by the Incumbent LEC. This could affect either in-service calls or the availability of service. The CLEC test equipment must be able to determine when a line is in use for POTS service and not test the line if the line is in use for POTS. This detection becomes very difficult in the case where a POTS line is performing on-hook transmission and a large drop in DC voltage due to an off-hook condition cannot be sensed on the loop.

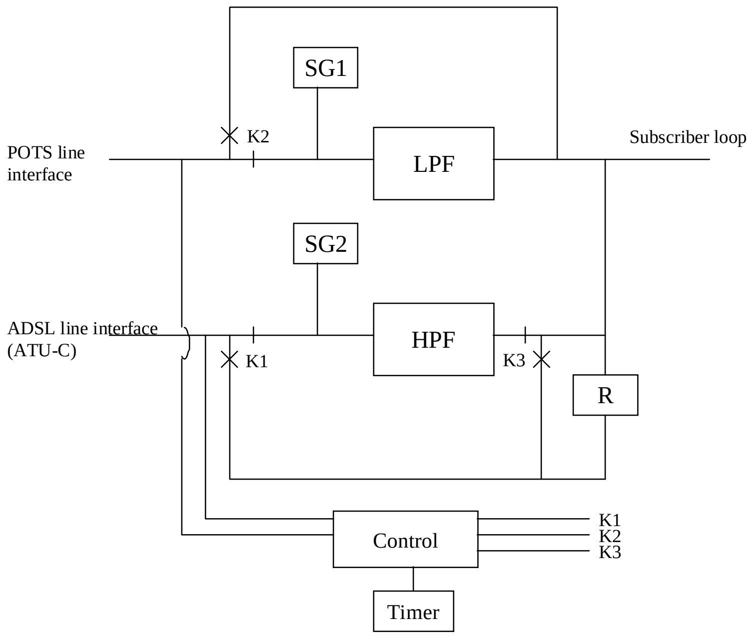
- To ensure that POTS service is provided after testing or if a failure of the test equipment occurs, a time-out feature must be implemented for CLEC test access.

A complete list of the desired line sharing test access requirements can be found in the Sprint contribution to the T1E1.4 working group of Committee T1-Telecommunications (Contribution T1E1/2000-266, "Line Sharing Test Access Requirements"):

> "In a line-shared environment, CLECs must be able to fully test their data network. At the same time, ILECs must be assured of the integrity of their voice service, as well as have test access to the network for spectrum management troubleshooting. Any line-sharing test access solution must also be relatively simple to implement and be cost effective. This contribution proposes requirements for line sharing test access. These requirements can be used as a basis for defining a standard architecture for line sharing test access:
>
> - The CLEC must have the ability to gain full bandwidth access to a shared loop from a remote location.
>
> - The ILEC must have the ability to gain full bandwidth access to a shared loop for interference isolation.
>
> - The CLEC must be able to detect if the voice line is off-hook. This monitoring must be non-intrusive to the voice line.
>
> - The CLEC must be able to verify connectivity from the collocation area to the customer premises.
>
> - The CLEC must be able to remove the ILEC-supplied battery and ground from the loop to perform testing.

- DC blocking capacitors must be disconnected from the loop during CLEC testing.
- The CLEC must be able to perform basic DC tests; loop length, balance and presence of load coils.
- The CLEC must be able to access the shared loop to examine loop characteristics using a Time Domain Reflectometer (TDR).
- The CLEC must be able to access the shared loop to perform spectrum analysis using a wide-band noise test set.
- Intrusive CLEC loop testing must be completed within a timeout period. The timeout period must be adjustable and extendible within limits, (e.g. minimum of 30 seconds to maximum of 5 minutes).
- If a power failure or control failure occurs during CLEC testing, normal POTS operation must be restored within a pre-set time period.
- Normal POTS operation must be restored upon the failure of test access components.
- The POTS splitter must not require powering.
- Loop test access must be compatible with existing POTS splitter chassis and wiring.
- Loop test access must provide "equal access" to any number of CLECs.
- Remote test access on non-shared lines must be secure.
- Test technologies that have already been deployed must be utilized to the extent possible.

To address these requirements, vendors have proposed many different solutions. In general, the requirements drive one towards a solution that adds many functional elements to the traditional POTS Splitter. A block diagram of a possible solution addressing many of the above requirements is shown in Figure 4.



"Smart" POTS Splitter to support line sharing test access requirements

Figure 4

The elements that are incremental to those in the traditional POTS Splitter are:

- SG2, which is a signature that the CLEC test head can detect to determine the presence of a POTS splitter

- K2, which provides the ILEC with a short circuit across the LPF to allow full spectrum access to the subscriber loop

- K1, which allows the CLEC test head to unobtrusively monitor the subscriber loop through a high impedance (R) to determine if the POTS line is in use

- K3, which, when operated with K1, provides the CLEC with a short circuit across the HPF to allow full spectrum access to the subscriber loop (including DC)

- A control block, which controls the relays identified above in response to control signals from either the ILEC or CLEC test heads (controlled via longitudinal signals from the test head)

- A timer to ensure that in a time-out scenario, all relay contacts are released so that the lifeline POTS service can be restored

A "Smart" POTS Splitter, like that pictured above, is one of the many solutions being proposed to address the operational problems identified. All line-sharing test access solutions share the common theme of adding additional complexity to the POTS Splitter and ILEC/CLEC test heads. The addition of more complexity to the POTS Splitter makes it even larger and more costly than the traditional POTS Splitter. This additional size may be tolerable (although undesirable) in the central office environment, but in the remote cabinet, it is not feasible.

Direction of Technology Innovation and Standards

Enabling of Future Services with Full Frequency Spectrum Splitterless Integrated POTS + DSL Deployments

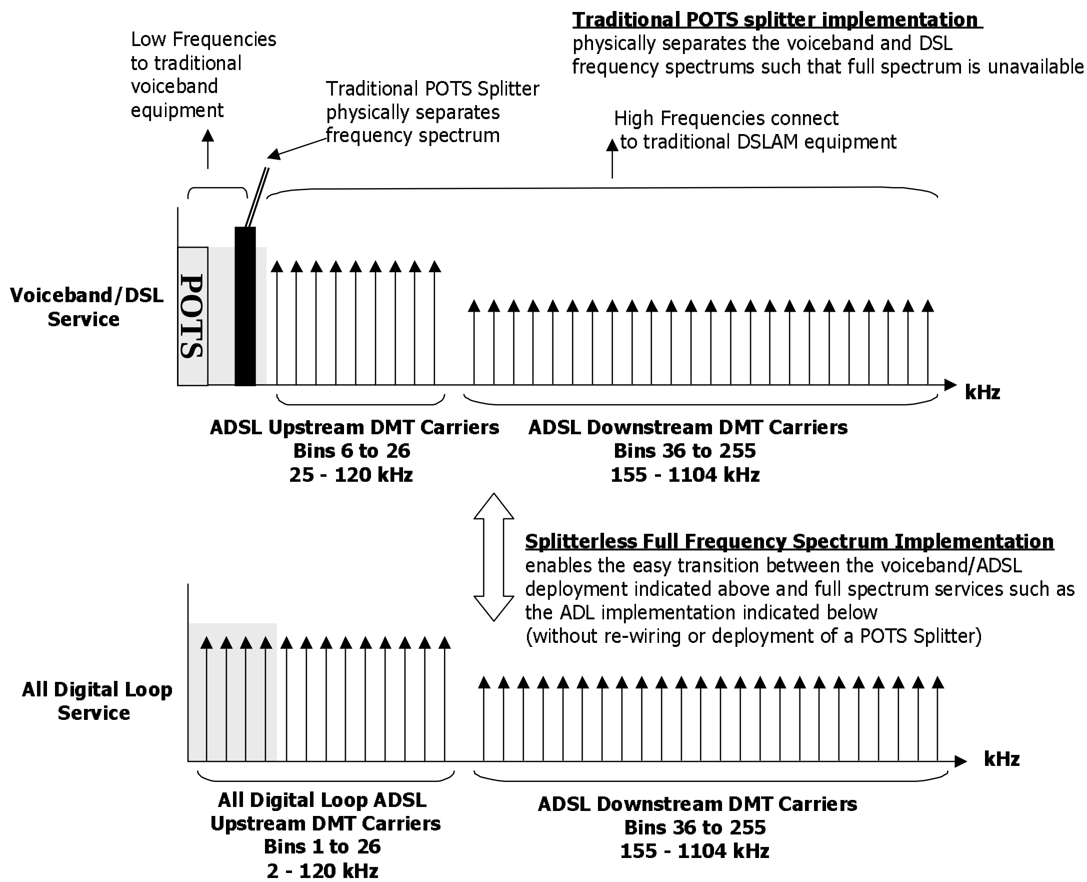
Today's typical deployments of Central Office-based access equipment include physical "POTS Splitters" which partition the access loop frequency spectrum. Low frequencies are connected to traditional voiceband equipment and high frequencies are connected to traditional DSLAM equipment. This approach impedes the efficiency of evolution to future services.

A full-frequency spectrum splitterless connection to next-generation integrated POTS + DSL linecards enables a simple evolution from today's analog POTS service to various existing, or newly evolving, services. The built-in POTS splitting function of the next-generation POTS + DSL linecards results in the operator being able to simply switch between services that require a POTS Splitter function, and those that do not. Evolving services are enabled without having to install/remove a physical POTS splitter and/or the associated wiring.

Various new services, which require access to the full frequency spectrum, are gaining momentum. A few examples of these new services are G.shdsl and the All Digital Loop (ADL) version of ADSL. Such technologies will be deployed soon. G.shdsl specifications are nearing completion at the ITU, T1E1.4 and other standards bodies, and much other work has been completed.

- ITU-T Study group question 4/15 G.shdl specification is G.991.2
- The All Digital Loop (ADL) version of ADSL is also being progressed at the ITU, T1E1 and other standards bodies
- ITU-T Study group question 4/15 ADSL specification is ITU G.DMT.bis (evolution of G.992.1)
- ITU Contributions D.730, MA-069, MA-076R1, NG-034, NG-079R1, NT-116, FI039, FI-090, HC-035, HC-036 relate to ADL
- T1E1.4 contributions 0e141790, 0e141800 and 0e142550 relate to ADL

The evolution of full-frequency spectrum splitterless access loop technologies is expected to continue.



Frequency Spectrum Implementations

Figure 5

These advances in technology will greatly enhance the capacity of advanced broadband services. However, mandating continued use of a POTS Splitter (particularly at remote terminals) would negate these advances. Furthermore, any regulatory policy requiring the use of POTS Splitters will strand 27 KHz of precious, non-renewable spectrum. The Commission must be careful not to implement a regulatory policy that impedes technology innovation, prevents exciting new services and strands prime bandwidth.

Conclusion

As reflected in Section 706 of the Communications Act, it clearly is in the public interest for the Commission to ensure that advanced services are ubiquitous, affordable and available to all Americans. The Commission must recognize that advanced services deployment from remote terminals is extremely different than the environment available in Central Offices. Merely extending the Central Office collocation model to the remote terminal is <u>not</u> an economically feasible or viable option. In fact, the Commission has recognized that a different treatment is required for the remote terminal environment. This is reflected in its favorable ruling on the *Pronto Waiver*, which allows SBC to implement a virtual collocation model for the deployment of advanced services at remote terminals. We strongly urge the Commission to continue its forward thinking on such virtual collocation. Virtual collocation, and the deployment of integrated POTS+DSL plug-in cards and solutions, allows service providers to deploy the most cost effective and efficient network architectures, lowers the economic barriers for competitive providers, eliminates the costs and complexities of mechanical POTS Splitters and enables the continued innovation of technology and future services. In addition, allowing ILECs and CLECs to take advantage of the benefits of integrated POTS + DSL technology will enhance their competitiveness vis-à-vis broadband services provided over alternative media, such as wireless and cable modems. The *Further NPRM* provides the Commission a great opportunity to again take a giant step forward in making advanced services ubiquitous, affordable and available to all Americans.

Respectfully submitted,

By: ___ /s/ ___

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Dated: October 12, 2000